

**CLAIMS**

What is claimed is:

- 1 1. A read/write head for use in a data storage device to reduce pole tip protrusion,  
2 comprising:  
3 an air bearing surface;  
4 a pole tip region;  
5 an insulation layer formed adjacent to the pole tip region;  
6 a coil embedded in the insulation layer contributing to a protrusion force that  
7 generates a pole tip protrusion; and  
8 a layer of thermally expansive material formed over the insulation layer, and  
9 recessed from the air bearing surface, that expands in response to heat absorption,  
10 causing a rotational moment of force that counteracts the protrusion force thus reducing  
11 the pole tip protrusion.
- 1 2. The read/write head of claim 1, wherein the layer of thermally expansive  
2 material is made at least in part of photoresist material.
- 1 3. The read/write head of claim 1, wherein the layer of thermally expansive  
2 material has a coefficient of thermal expansion that ranges between approximately 5  
3 ppm/K and 100 ppm/K.
- 1 4. The read/write head of claim 1, further comprising a write element; and  
2 wherein the layer of thermally expansive material is formed over substantially  
3 the entire surface of the write element.

1 5. The read/write head of claim 4, further comprising a diffuser formed on top of  
2 the insulation layer; and  
3 wherein the layer of thermally expansive material is formed over the diffuser.

1 6. The read/write head of claim 5, wherein the diffuser is formed over substantially  
2 the entire surface of the write element.

1 7. The read/write head of claim 5, wherein the write element is comprised of a first  
2 pole layer P1, a second pole layer P2, and a third pole P3.

1 8. The read/write head of claim 1, further comprising a read element.

- 1 9. A write element for use in a read/write head having an air bearing surface to  
2 reduce pole tip protrusion, comprising:  
3 a pole tip region;  
4 an insulation layer formed adjacent to the pole tip region;  
5 a coil embedded in the insulation layer contributing to a protrusion force that  
6 generates a pole tip protrusion; and  
7 a layer of thermally expansive material formed over the insulation layer, and  
8 recessed from the air bearing surface, that expands in response to heat absorption,  
9 causing a rotational moment of force that counteracts the protrusion force thus reducing  
10 the pole tip protrusion.
- 1 10. The write element of claim 9, wherein the layer of thermally expansive material  
2 is made at least in part of photoresist material.
- 1 11. The write element of claim 9, wherein the layer of thermally expansive material  
2 has a coefficient of thermal expansion that ranges between approximately 5 ppm/K and  
3 100 ppm/K.
- 1 12. The write element of claim 9, further comprising a diffuser formed on top of the  
2 insulation layer; and  
3 wherein the layer of thermally expansive material is formed over the diffuser.
- 1 13. The write element of claim 9, wherein the write element is comprised of a first  
2 pole layer P1, a second pole layer P2, and a third pole P3.

- 1 14. A disk drive comprising:  
2 a base;  
3 a spindle motor attached to the base;  
4 a disk positioned on the spindle motor;  
5 a head stack assembly coupled to the base and comprising:  
6 an actuator body;  
7 an actuator arm cantilevered from the actuator body; and  
8 a read/write head coupled to the actuator arm, and including:  
9 an air bearing surface;  
10 a pole tip region;  
11 an insulation layer formed adjacent to the pole tip region;  
12 a coil embedded in the insulation layer contributing to a  
13 protrusion force that generates a pole tip protrusion; and  
14 a layer of thermally expansive material formed over the  
15 insulation layer, and recessed from the air bearing surface, that expands  
16 in response to heat absorption, causing a rotational moment of force that  
17 counteracts the protrusion force thus reducing the pole tip protrusion.
- 1 15. The disk drive of claim 14, wherein the layer of thermally expansive material is  
2 made at least in part of photoresist material.
- 1 16. The disk drive of claim 14, wherein the layer of thermally expansive material  
2 has a coefficient of thermal expansion that ranges between approximately 5 ppm/K and  
3 100 ppm/K.
- 1 17. The disk drive of claim 14, further comprising a write element; and  
2 wherein the layer of thermally expansive material is formed over substantially  
3 the entire surface of the write element.

1 18. The disk drive of claim 14, further comprising a diffuser formed on top of the  
2 insulation layer; and  
3 wherein the layer of thermally expansive material is formed over the diffuser.

1 19. The disk drive of claim 18, wherein the diffuser is formed over substantially the  
2 entire surface of the write element.

1 20. The disk drive of claim 14, further comprising a read element.